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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/580,196

01/24/2007

Volker Gallatz

51253

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1609 7590 04/02/2008

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EXAMINER

COLEMAN, KEITH A

ART UNIT

PAPER NUMBER

3747

MAIL DATE

DELIVERY MODE

04/02/2008

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/580,196	Applicant(s) GALLATZ ET AL.	
	Examiner KEITH COLEMAN	Art Unit 3747	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 February 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-14 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-14 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 23 May 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- ☒ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>9/5/2007;5/23/2006</u> | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Amendment

In response to preliminary amendment filed on 2/22/2008, the office action mailed 2/15/2008 is hereby VACATED and a new office action follows:

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to

consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ward (US Patent No. 4,138,980).

With regards to claim 1, the patent to Ward discloses a process for ignition of combustion of fuel in the combustion space (i.e. interior of chamber 22, See Figure 1) of an engine (Col. 1, Line 17) by injecting into the combustion space (i.e. interior of chamber 22, See Figure 1) microwave radiation produced in a microwave source (10, Col. 4, Line 52, Figure 1) outside of the combustion space (i.e. interior of chamber 22, Figure 1), the injected microwave radiation being absorbed by the fuel distributed in the combustion space (i.e. interior of chamber 22, Col. 5, Lines 30-40 and Lines 50-60), and due to the energy delivery into the fuel which occurs due to absorption the combustion being ignited essentially at the same time (Col. 5, Lines 50-60), distributed over a large volume in the combustion space (i.e. the entire volume of the interior of chamber 22, Col. 5, Lines 30-40 and Lines 50-60), except positively disclosing preferably uniformly distributed in the entire combustion space. Since Ward explicitly states on Col. 3, Lines 37-45 that "For combustion chambers of arbitrary shape or changing shape, one can **optimize coupling of the microwave energy** by operating at frequencies with corresponding wavelengths smaller than the chamber dimensions. In this way microwave energy can be radiated out to the flame, and also one or more standing waves, or cavity modes, can be set up which permits the maintenance of **continuous**

high electric fields.”, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the engine of Ward with wherein the microwaves are uniformly distributed in the entire combustion space in order to maintain an equilibrium (Col. 3, Line 46 from Ward)

With regards to claim 2, the patent to Ward discloses wherein the microwave radiation is injected in the form of one or more microwave pulses of short time duration and high energy (See Col. 3, Lines 37-45 and rejection in claim 1).

With regards to claim 3, the patent to Ward discloses wherein the number of microwave pulses and/or their power and/or their pulse duration and/or their instant is controlled depending on the operating state of the engine (i.e. electromagnetic wave frequencies, Col. 3, Lines 1-5, dependent on speed of combustion reactions, Col. 2, Lines 60-65, lean combustion, Col. 1, Lines 40-45) and the power demand on the engine (i.e. watts needed to combust fuel, See Col. 5, Lines 33-36).

With regards to claim 4, the patent to Ward discloses wherein preferably 1 to 10 microwave pulses, especially 1 to 5 microwave pulses, are used (i.e. a wave, See Col. 3, Line 42), preferably with a power between 1 kW and 70 kW (i.e. 1KW, See Col. 5, Line 35), a pulse duration (i.e. one cycle) between 1 ns and 2 ms (i.e. 3×10^8 Hz [cycles per second] is inherently 3.3×10^{-9} seconds per cycle or 3.3 nanoseconds per cycle), except positively disclosing a pulse spacing between 100 ns and 2 ms (i.e. $3 \times$

10¹⁰ Hz is inherently 333.33 x 10⁻⁹ or 333 nanoseconds). It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the engine of Ward (US Patent No. 4,138,980) with a pulse spacing between 100 ns and 2 ms (i.e. 3 x 10¹⁰ Hz is inherently 333.33 x 10⁻⁹ or 333 nanoseconds) because the modification is invariably a change in optimized range. See MPEP 2144.04. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955) (Claimed process which was performed at a temperature between 40°C and 80°C and an acid concentration between 25% and 70% was held to be *prima facie* obvious over a reference process which differed from the claims only in that the reference process was performed at a temperature of 100°C and an acid concentration of 10%.); see also *Peterson*, 315 F.3d at 1330, 65 USPQ2d at 1382 (“The normal desire of scientists or artisans to improve upon what is already generally known provides the motivation to determine where in a disclosed set of percentage ranges is the optimum combination of percentages.”)

With regards to claim 5, the patent to Ward discloses wherein for the ignition process several microwave pulses with preferably different power and/or pulse duration are injected (i.e. one or more standing waves or cavity modes, See Col. 3, 36-44) except positively disclosing guarantee leveling of the temperature increase of the fuel distributed in the combustion space up to the ignition temperature by gradual delivery of energy. However, Ward explicitly states on Col. 5, Lines 40-57 that “As a matter of definition, a severe perturbation of the flame front electron plasma is one that produces a rise in **flame front electron temperature equal to or greater than the initial electron**

temperature” it would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the engine of Ward with wherein guarantee leveling of the temperature increase of the fuel distributed in the combustion space up to the ignition temperature by gradual delivery of energy because the modification is invariably a change in optimized range. See MPEP 2144.04. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955) (Claimed process which was performed at a temperature between 40°C and 80°C and an acid concentration between 25% and 70% was held to be *prima facie* obvious over a reference process which differed from the claims only in that the reference process was performed at a temperature of 100°C and an acid concentration of 10%.); see also *Peterson*, 315 F.3d at 1330, 65 USPQ2d at 1382 (“The normal desire of scientists or artisans to improve upon what is already generally known provides the motivation to determine where in a disclosed set of percentage ranges is the optimum combination of percentages.”)

With regards to claim 6, the patent to Ward discloses all the limitations of the claimed subject matter including wherein the formation of a plasma (Col. 5, Lines 40-45) in the combustion space (i.e. interior of chamber 22) is prevented by the choice of the time interval of injection of microwave radiation (i.e. dependent on the power source), its power and optionally the pulse duration (i.e. 3×10^8 Hz [cycles per second] is inherently 3.3×10^{-9} seconds per cycle or 3.3 nanoseconds per cycle) except positively disclosing pulse spacing. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the engine of Ward (US

Patent No. 4,138,980) with wherein the formation of a plasma is dependent on pulse spacing because the modification is invariably a change in optimized range. See MPEP 2144.04. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955) (Claimed process which was performed at a temperature between 40°C and 80°C and an acid concentration between 25% and 70% was held to be *prima facie* obvious over a reference process which differed from the claims only in that the reference process was performed at a temperature of 100°C and an acid concentration of 10%.); see also *Peterson*, 315 F.3d at 1330, 65 USPQ2d at 1382 (“The normal desire of scientists or artisans to improve upon what is already generally known provides the motivation to determine where in a disclosed set of percentage ranges is the optimum combination of percentages.”)

With regards to claim 7, the patent to Ward discloses a microwave source (10) located outside of the combustion space (i.e. interior of chamber 22) and a microwave window (i.e. spark plug 20, See Claim 10) connected to the microwave source (10), and the microwave radiation can be injected into the combustion space (i.e. interior of chamber 22) by way of the microwave window (i.e. spark plug 20, See Claim 10) so that the injected microwave radiation can be absorbed by the fuel distributed in the combustion space (i.e. interior of chamber 22), and due to the energy delivery into the fuel which occurs due to absorption combustion can be ignited essentially simultaneously (Abstract), distributed over a large volume in the combustion space (i.e. interior of chamber 22), except positively disclosing preferably uniformly distributed in

the entire combustion space. Since Ward explicitly states on Col. 3, Lines 37-45 that “For combustion chambers of arbitrary shape or changing shape, one can **optimize coupling of the microwave energy** by operating at frequencies with corresponding wavelengths smaller than the chamber dimensions. In this way microwave energy can be radiated out to the flame, and also one or more standing waves, or cavity modes, can be set up which permits the maintenance of **continuous high electric fields.**”, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the engine of Ward with wherein the microwaves are uniformly distributed in the entire combustion space in order to maintain an equilibrium (Col. 3, Line 46 from Ward)

With regards to claim 8, the patent to Ward discloses wherein the microwave source (10) is supplied by an electric power supply source (See Figure 1) which delivers electrical pulses which can be converted into microwave pulses by the microwave source (10).

With regards to claim 9, the patent to Ward discloses wherein between the microwave source (10) and the microwave window (i.e. spark plug 20, See Claim 10), preferably over the course of the microwave line (18), there is a coupling means (24) which transmits the microwaves sent from the microwave source (10) to the microwave window (i.e. spark plug 20, See Claim 10), but which does not transmit the microwaves

reflected by the combustion space (i.e. interior of chamber 22) back into the microwave source (10, See Col. 4, Lines 65-68).

With regards to claim 10, the patent to Ward discloses wherein the coupling means (24a) has a triple port, especially a circulator (i.e. distributor 12) with a microwave source (10) connected to its first port (24a), a microwave window (i.e. spark plug 20 connected 18a) connected to its second port, and a preferably passive microwave consumer (16, 24a to 28a) connected to its third port.

Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ward (US Patent No. 4,138,980) in view of Ward (US Patent No. 4,297,983).

With regards to claim 11, the patent to Ward (US Patent No. 4,138,980) discloses all the limitations of the claimed subject matter except wherein the microwave window has a ceramic material.

Ward (US Patent No. 4,297,983) discloses wherein the microwave window (i.e. the opening for microwave coupler 50) has a ceramic material (76, Col. 10, Lines 15-20, See Figure 9).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to provide the microwave window of Ward (US Patent No. 4,138,980) with wherein the microwave window has a ceramic material in view of the teaching to Ward (US Patent No. 4,297,983), in order to lower the resonant frequency

and provide a higher Q.sub.c because of the increased "electrical" chamber volume (Col. 10, Lines 20-24 from Ward (US Patent No. 4,297,983)).

Claims 12 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ward (US Patent No. 4,138,980) in view of Ward (US Patent No. 4,297,983) as applied to claim 11 above, and further in view of Nichol (US Patent No. 2,563,952)

With regards to claim 12, the combination of Ward (US Patent No. 4,138,980) and Ward (US Patent No. 4,297,983) discloses all the limitations of the claimed subject matter including Ward disclosure of wherein the microwave source (10) is connected to the microwave window (i.e. spark plug 20, See Claim 10) by a microwave line (18a).except positively disclosing by a flexible microwave line.

Nichol discloses a flexible microwave line (19, See Figure 2).
It would have been obvious to a person of ordinary skill in the art at the time the invention was made to substitute the cable of the combination of Ward (US Patent No. 4,138,980) and Ward (US Patent No. 4,297,983) with flexible microwave line in view of the teaching to Nichol, in order to dampen and suppress oscillations commonly generated in an ignition system (Col. 1, Lines 5-10)

With regards to claim 13, the patent to Ward (US Patent No. 4,138,980) discloses ignition of the combustion of fuel in the combustion space (i.e. interior of chamber 22) of an engine (2).

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ward (US Patent No. 4,138,980), Nichol (US Patent No. 2,563,952) in view of Ward (US Patent No. 4,297,983) as applied to claims above, and further in view of Ward (US Patent No. 3,934,566, Provided by Applicant)

With regards to claim 14, the combination of Ward (US Patent No. 4,138,980), Ward (US Patent No. 4,297,983), and Nichol (US Patent No. 2,563,952) discloses all the limitations of the claimed subject matter including Ward disclosure of wherein a fuel-air mixture is ignited in the combustion space (i.e. interior of chamber 22) except positively disclosing wherein the engine is a diesel engine.

The patent to Ward (US Patent No. 3,934,566) discloses wherein the engine a diesel (See Col. 10, Lines 40-46) engine.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to substitute the engine of the combination of Ward (US Patent No. 4,138,980), Ward (US Patent No. 4,297,983), and Nichol (US Patent No. 2,563,952) with diesel engine in view of the teaching to Ward (US Patent No. 3,934,566), in order to increase efficiency and/or decrease exhaust emissions of an internal combustion engine (Col. 1, Lines 5-10 from Ward (US Patent No. 3,934,566)).

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Cesa (US Patent No. 7,201,882) shows the current state of the art.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KEITH COLEMAN whose telephone number is (571)270-3516. The examiner can normally be reached on 5:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Cronin can be reached on (571)272-4536. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

KAC
/K. C./
Examiner, Art Unit 3747
/Stephen K. Cronin/
Supervisory Patent Examiner, Art Unit 3747

